

## Calving and calving management of beef cows and heifers on cow–calf operations in the United States

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### Abstract

A national sample of cow–calf producers was contacted to participate in a study to describe selected calving management practices on operations throughout the United States. Information was gathered on calving season, frequency of dystocia, frequency of observation, timing of assistance, and calving facilities. Regional and herd size differences existed in all parameters evaluated. Most calves (63.9%) were born in the months of February, March, and April. Overall, 16.7% of heifers and 2.7% of cows required some level of assistance in calving. Heifers and cows were checked an average of only 3.6 and 2.5 times per 24 h period during the calving season. Producers allowed heifers to labor for an average of 2.8 h prior to lending assistance in calving while cows were allowed an average of 3.5 h before providing assistance. In addition, only 39.6% of calvings took place in specialized calving areas presumably to allow increased observation frequency, timely intervention and protection from the elements. Collectively, these management practices illustrate that opportunities exist to improve calf survivability and increase reproductive efficiency in many cow herds.

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## 1. Introduction

The cow–calf operation is a business focused on producing beef. The sustaining force in the production process is reproduction among the breeding herd, for without reproduction there is no production. For this reason, a great deal of interest has been focused on the reproductive efficiency of beef cattle. Loss of calves is of critical importance to reproductive efficiency. The most common reason identified for losing calves in earlier studies has been dystocia [1–3]. Reproductive efficiency is also affected by calving management practices [4–6]. The goal of successful calving management is the optimization of calf survivability and dam breeding efficiency. The objective of this study was to obtain national estimates of the prevalence of dystocia and the frequency of selected calving management practices in beef herds. These national estimates will aid not only in the recognition of opportunities for change for the producer but also the development of educational and research programs aimed at increasing production efficiency.

## 2. Materials and methods

A stratified random sample of 4092 operations from 23 selected states<sup>1</sup> expected to have beef cows was selected by the National Agricultural Statistics Service (NASS) from their list frame of farm operations. NASS enumerators attempted to contact all of the operations selected for phase one of the study to conduct a personal interview regarding management practices employed. These contacts were made between 30 December 1996 and 3 February 1997.

Noninstitutional operations with one or more beef cows were eligible to participate in phase one. The enumerators administered a questionnaire to operations that met the inclusion criteria for the study and were willing to participate. In phase two of the study all operations that participated in phase one and had at least five beef cows were eligible to continue in the study. For these operations, a veterinarian or animal health technician from the USDA, Animal and Plant Health Inspection Service, Veterinary Services visited the operation between 3 March and 23 May 1997, to administer another questionnaire. Population estimates were calculated according to standard techniques [7]. In some cases, population estimates were made for regions (see footnote 1) and herd sizes. The overall reference population for phase one of the study includes 77.6% of the operations with beef cows in the United States and 85.7% of the beef cows in the United States. The reference population for phase two of the study includes 66.3% of the operations with beef cows in the United States and 85.0% of the beef cows in the United States. The size of the reference population by region and herd size is shown in Table 1.

Statistical comparisons for qualitative and quantitative data were made using software that accounts for the sampling design of the study [8]. Qualitative data were compared using a chi-square test. Quantitative data were compared using an analysis of variance

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<sup>1</sup> West: California, Colorado, Montana, New Mexico, Oregon, and Wyoming; North central: Kansas, Nebraska, North Dakota, and South Dakota; South central: Oklahoma and Texas; Central: Arkansas, Illinois, Iowa, and Missouri; Southeast: Alabama, Florida, Georgia, Kentucky, Mississippi, Tennessee, and Virginia.

Table 1  
Reference population sizes

	Number of operations (thousand) <sup>a</sup>	Number of beef cows (thousand head) <sup>b</sup>
Region		
West	64.4	5150
North central	82.4	6021
South central	187.0	7425
Central	135.8	4519
Southeast	229.0	6260
Herd size (beef cows)		
1–49	536.7	8501
50–99	94.6	5852
100–299	57.4	9305
>300	9.9	5717

<sup>a</sup> Operations with beef cows in 1996.

<sup>b</sup> 1 January 1997 inventory.

procedure. No procedure was available in the software to account for multiple comparisons so the *P*-values reported have not been adjusted.

### 3. Results

#### 3.1. Selection of calving season

Most producers (53.6%) had no set breeding season (i.e. they did not remove the bulls from the female herd for at least one month at some point during the year). The largest percentages of all calves were born in March (27.2%). Most of the calves (63.9%) were born in the months of February, March, and April.

For operations with a single breeding season, the anticipated weather conditions during the calving season (39.4% of operations) had the most influence on the timing of the 1996 calving season. Tradition was the next most commonly used factor determining the timing of the calving season (29.7% of operations) (Table 2). Surprisingly, forage availability was used by only 9.3% of producers as the criterion for timing their calving season. Labor availability was a factor on only 3.8% of operations. All other factors including increased weaning weights, market cycle, and timing of livestock movement were reported as the primary influencing factor on timing of the calving season by less than 6% of producers. The percentage of operations using various criteria for selection of the calving season varied by region and herd size (Tables 2 and 3).

On average, heifers were observed 3.6 times per 24 h during the calving season compared to 2.5 times per 24 h for cows (Tables 4 and 5). Overall, 93% of operations reported observation of heifers once or more per day during the calving season. Cows were observed less than once per day during the calving season on only 9.0% of operations. Most operations (63.9%) reported observing cows 1–2 times per 24 h during the calving season.

Table 2

Percentage of operations with a single calving season using various criteria for selection of a calving season by region

Criteria for selection of calving season	Region					
	West	North central	South central	Central	Southeast	All
Tradition	31.9	37.6	16.7	24.8	33.3	29.7
Weather	36.8	35.1	35.8	51.5	31.3	39.4
Forage availability	13.3	4.9	11.6	5.1	15.4	9.3
Increasing weaning weights	6.1	5.4	3.2	5.7	5.1	5.3
Market cycle	5.0	2.3	11.6	5.7	7.3	5.7
Labor availability	2.4	7.4	1.3	4.6	0.8	3.8
Timing of herd movement	2.3	5.7	17.6	1.6	2.0	4.5
Other	2.3	1.7	2.1	1.1	4.8	2.3

Overall chi-square  $P$ -value < 0.001.

Table 3

Percentage of operations with a single calving season using various criteria for selection of a calving season by herd size

Criteria for selection of calving season	Herd size (number of cows)				
	1–49	50–99	100–299	>300	All
Tradition	28.8	31.8	32.5	24.0	29.7
Weather	42.9	35.5	30.0	35.5	39.4
Forage availability	8.3	9.2	12.6	12.4	9.3
Increasing weaning weights	4.0	7.8	8.3	5.0	5.3
Market cycle	6.3	4.8	3.6	10.2	5.7
Labor availability	2.3	7.6	5.4	4.8	3.8
Timing of herd movement	4.8	2.2	6.0	4.8	4.5
Other	2.6	1.1	1.7	3.3	2.3

Overall chi-square  $P$ -value < 0.001.

Table 4

Mean frequency of observation of heifers and cows per 24 h period during calving and allowed labor time by region

Practice (means $\pm$ S.E.M.)	Region					
	West	North central	South central	Central	Southeast	All
Frequency of observation during calving						
Heifers	5.4 $\pm$ 0.3 <sup>a</sup>	5.8 $\pm$ 0.3 <sup>a</sup>	2.0 $\pm$ 0.1 <sup>b</sup>	3.4 $\pm$ 0.2 <sup>c</sup>	2.2 $\pm$ 0.2 <sup>b</sup>	3.6 $\pm$ 0.1
Cows	3.8 $\pm$ 0.2 <sup>a</sup>	4.3 $\pm$ 0.2 <sup>a</sup>	1.6 $\pm$ 0.1 <sup>b</sup>	2.5 $\pm$ 0.1 <sup>c</sup>	1.9 $\pm$ 0.1 <sup>d</sup>	2.5 $\pm$ 0.1
Hours of labor allowed before assistance						
Heifers	2.1 $\pm$ 0.2 <sup>a</sup>	2.0 $\pm$ 0.1 <sup>a</sup>	3.1 $\pm$ 0.3 <sup>b</sup>	3.1 $\pm$ 0.5 <sup>b</sup>	3.4 $\pm$ 0.3 <sup>b</sup>	2.8 $\pm$ 0.1
Cows	3.1 $\pm$ 0.4 <sup>a,b,c</sup>	2.3 $\pm$ 0.1 <sup>a</sup>	3.9 $\pm$ 0.3 <sup>b</sup>	3.2 $\pm$ 0.2 <sup>c</sup>	4.0 $\pm$ 0.2 <sup>b</sup>	3.5 $\pm$ 0.1

(a–d) Values in the same row without a common superscript are different ( $P$  < 0.05).

Table 5

Mean frequency of observation of heifers and cows per 24 h period during calving and allowed labor time by herd size

Practice (means $\pm$ S.E.M.)	Herd size (number of cows)				
	1–49	50–99	100–299	>300	All
Frequency of observation during calving					
Heifers	2.8 $\pm$ 0.2 <sup>a</sup>	3.8 $\pm$ 0.2 <sup>b</sup>	5.1 $\pm$ 0.3 <sup>c</sup>	6.5 $\pm$ 0.5 <sup>d</sup>	3.6 $\pm$ 0.1
Cows	2.2 $\pm$ 0.1 <sup>a</sup>	2.8 $\pm$ 0.1 <sup>b</sup>	3.5 $\pm$ 0.2 <sup>c</sup>	3.7 $\pm$ 0.3 <sup>c</sup>	2.5 $\pm$ 0.1
Hours of labor allowed before assistance					
Heifers	3.0 $\pm$ 0.2 <sup>a</sup>	2.6 $\pm$ 0.1 <sup>a,b</sup>	2.3 $\pm$ 0.1 <sup>b</sup>	2.3 $\pm$ 0.3 <sup>b</sup>	2.8 $\pm$ 0.1
Cows	3.6 $\pm$ 0.2 <sup>a</sup>	3.2 $\pm$ 0.2 <sup>a,b</sup>	3.2 $\pm$ 0.5 <sup>a,b</sup>	2.8 $\pm$ 0.3 <sup>b</sup>	3.5 $\pm$ 0.1

(a–d) Values in the same row without a common superscript are different ( $P < 0.05$ ).

Table 6

Mean percentage of heifer and cow calvings requiring various levels of assistance by region

Assistance level (means $\pm$ S.E.M.)	Region					
	West	North central	South central	Central	Southeast	All
Heifers						
Easy pull	12.6 $\pm$ 1.1 <sup>a</sup>	16.3 $\pm$ 1.5 <sup>a</sup>	6.8 $\pm$ 1.9 <sup>b</sup>	8.8 $\pm$ 1.4 <sup>b</sup>	7.0 $\pm$ 1.4 <sup>b</sup>	11.1 $\pm$ 0.8
Hard pull	6.6 $\pm$ 0.8 <sup>a</sup>	6.0 $\pm$ 0.9 <sup>a,b</sup>	2.9 $\pm$ 0.7 <sup>c</sup>	3.8 $\pm$ 0.7 <sup>b,c</sup>	4.6 $\pm$ 1.0 <sup>a,b,c</sup>	5.1 $\pm$ 0.4
Cesarian section	0.6 $\pm$ 0.1 <sup>a</sup>	0.7 $\pm$ 0.1 <sup>a</sup>	0.2 $\pm$ 0.1 <sup>b</sup>	0.2 $\pm$ 0.1 <sup>b</sup>	0.0 $\pm$ 0.0 <sup>b</sup>	0.4 $\pm$ 0.1
No assistance	80.2 $\pm$ 1.6 <sup>a</sup>	77.0 $\pm$ 1.6 <sup>a</sup>	90.1 $\pm$ 2.2 <sup>b</sup>	87.2 $\pm$ 1.7 <sup>b</sup>	88.3 $\pm$ 1.8 <sup>b</sup>	83.3 $\pm$ 0.9
Cows						
Easy pull	1.9 $\pm$ 0.4 <sup>a,b</sup>	2.1 $\pm$ 0.2 <sup>a</sup>	0.9 $\pm$ 0.2 <sup>c</sup>	3.5 $\pm$ 0.7 <sup>a</sup>	1.4 $\pm$ 0.2 <sup>b</sup>	1.8 $\pm$ 0.1
Hard pull	0.8 $\pm$ 0.2 <sup>a,c</sup>	1.2 $\pm$ 0.1 <sup>b</sup>	0.5 $\pm$ 0.2 <sup>c</sup>	1.1 $\pm$ 0.2 <sup>a,b</sup>	0.8 $\pm$ 0.1 <sup>a,c</sup>	0.9 $\pm$ 0.1
Cesarian section	0.0 $\pm$ 0.0 <sup>a,b</sup>	0.1 $\pm$ 0.0 <sup>b</sup>	0.0 $\pm$ 0.0 <sup>a,b</sup>	0.0 <sup>a</sup> $\pm$ 0.0	0.0 $\pm$ 0.0 <sup>a</sup>	0.0 $\pm$ 0.0
No assistance	97.3 $\pm$ 0.5 <sup>a,d</sup>	96.5 $\pm$ 0.2 <sup>a,b</sup>	98.6 $\pm$ 0.2 <sup>c</sup>	95.4 $\pm$ 0.8 <sup>b</sup>	97.8 $\pm$ 0.2 <sup>d</sup>	97.3 $\pm$ 0.2

(a–d) Values in the same row without a common superscript are different ( $P < 0.05$ ).

Geographic region and herd size differences existed in the frequency of observation of both heifers and cows (Tables 4 and 5). Heifers from the western and north central regions and those in larger herds were observed most frequently during the calving season. A similar pattern of observation frequency was seen for cows.

### 3.2. Assistance of calving cows and heifers

Most heifers (83.3%) required no assistance in calving and even more cows (97.3%) required no assistance (Tables 6 and 7). Overall, 11.2% of heifer calvings were considered an easy pull,<sup>2</sup> while 5.1% were considered a hard pull, and 0.4% required a cesarean section. For cows, 1.8% of deliveries were considered easy pulls, 0.9% hard pulls, and fewer than 0.1% required a cesarean section. The proportion of heifers requiring assistance

<sup>2</sup>No attempt was made to standardize the definitions for calving difficulty.

Table 7

Mean percentage of heifer and cow calvings requiring various levels of assistance by herd size

Assistance level (means $\pm$ S.E.M.)	Herd size (number of beef cows)				
	1–49	50–99	100–299	>300	All
<b>Heifers</b>					
Easy pull	9.2 $\pm$ 1.8 <sup>a</sup>	12.1 $\pm$ 1.3 <sup>a</sup>	11.2 $\pm$ 1.1 <sup>a</sup>	12.1 <sup>a</sup> $\pm$ 1.8	11.1 $\pm$ 0.8
Hard pull	4.4 $\pm$ 0.8 <sup>a</sup>	4.8 $\pm$ 0.6 <sup>a</sup>	6.0 $\pm$ 0.8 <sup>a</sup>	4.7 <sup>a</sup> $\pm$ 0.7	5.1 $\pm$ 0.4
Cesarian section	0.2 $\pm$ 0.1 <sup>a</sup>	0.5 $\pm$ 0.2 <sup>a,b</sup>	0.4 $\pm$ 0.1 <sup>a,b</sup>	0.5 <sup>b</sup> $\pm$ 0.1	0.4 $\pm$ 0.1
No assistance	86.2 $\pm$ 2.1 <sup>a</sup>	82.7 $\pm$ 1.6 <sup>a</sup>	82.3 $\pm$ 1.6 <sup>a</sup>	82.7 <sup>a</sup> $\pm$ 1.7	83.3 $\pm$ 0.9
<b>Cows</b>					
Easy pull	1.9 $\pm$ 0.3 <sup>a</sup>	2.4 $\pm$ 0.5 <sup>a</sup>	1.6 $\pm$ 0.2 <sup>a</sup>	1.5 <sup>a</sup> $\pm$ 0.3	1.8 $\pm$ 0.2
Hard pull	0.8 $\pm$ 0.1 <sup>a</sup>	1.0 $\pm$ 0.1 <sup>a</sup>	1.0 $\pm$ 0.2 <sup>a</sup>	0.6 $\pm$ 0.2 <sup>a</sup>	0.9 $\pm$ 0.1
Cesarian section	0.8 $\pm$ 0.1 <sup>a</sup>	1.0 $\pm$ 0.1 <sup>a</sup>	1.0 $\pm$ 0.2 <sup>a</sup>	0.6 $\pm$ 0.2 <sup>a</sup>	0.9 $\pm$ 0.1
No assistance	97.3 $\pm$ 0.3 <sup>a</sup>	96.6 $\pm$ 0.5 <sup>a</sup>	97.3 $\pm$ 0.3 <sup>a</sup>	97.8 <sup>a</sup> $\pm$ 0.5	97.3 $\pm$ 0.2

(a–d) Values in the same row without a common superscript are different ( $P < 0.05$ ).

in calving was related to geographic region (Table 6). Of the assisted calvings for heifers, 67.1% were considered easy pulls, 30.5% were considered hard pulls, and 2.4% required a cesarean section. The distribution for assisted calvings for cows was similar with 66.7% considered easy pulls, 33.3% hard pulls, and 3.7% required a cesarean section. Only 80.2% of heifers calved unassisted in the west compared to 88.3% in the southeast. The west also had the highest percentage of deliveries that were classified as hard pulls. A similar pattern of calving assistance was not evident for cows by geographic region. A higher proportion of heifers in the smallest herds (less than 50 cows) calved unassisted than for all other size groups though the difference was not statistically significant ( $P > 0.05$ ) (Table 7).

Approximately 40% of producers allowed heifers and cows to labor for 3 h or more on average. On average, producers allowed heifers to labor 2.8 h prior to giving assistance compared with 3.5 h for cows (Tables 4 and 5). Most operations (60.7%) reported allowing 1–2 h of labor before giving assistance to heifers. Over one-quarter of operations (27.1%) reported allowing 3–4 h of labor while only 12.2% of operations reported allowing five or more hours before giving assistance to a calving heifer.

Approximately 11.8% of all assisted calvings were attended by a veterinarian. The average proportion of all assisted births attended by a veterinarian was higher for cows than for heifers (Tables 8 and 9). The proportion of assisted deliveries attended by a veterinarian was related to region and herd size.

Table 8

Mean percentage of assisted births attended by a veterinarian by region

Parity (means $\pm$ S.E.M.)	Region				
	West	North central	South central	Central	Southeast
Heifers	5.7 $\pm$ 1.4 <sup>a</sup>	9.0 $\pm$ 1.4 <sup>a,b</sup>	17.2 $\pm$ 4.5 <sup>b,c</sup>	19.3 $\pm$ 3.3 <sup>c</sup>	9.5 $\pm$ 2.7 <sup>a,b</sup>
Cows	9.9 $\pm$ 1.0	10.4 $\pm$ 1.4 <sup>b</sup>	10.4 $\pm$ 1.4 <sup>b</sup>	17.8 $\pm$ 3.7 <sup>b</sup>	17.1 $\pm$ 3.2 <sup>b</sup>

(a–d) Values in the same row without a common superscript are different ( $P < 0.05$ ).

Table 9

Mean percentage of assisted births attended by a veterinarian by herd size

Parity (means $\pm$ S.E.M.)	Herd size (number of beef cows)				
	1–49	50–99	100–299	>300	All
Heifers	12.9 $\pm$ 2.6 <sup>a,b</sup>	13.8 $\pm$ 2.2 <sup>a</sup>	8.3 $\pm$ 1.7 <sup>a,b</sup>	7.7 $\pm$ 2.0 <sup>b</sup>	9.9 $\pm$ 1.0
Cows	19.8 $\pm$ 3.1 <sup>a</sup>	16.3 $\pm$ 3.0 <sup>a</sup>	8.0 $\pm$ 1.3 <sup>b</sup>	4.3 $\pm$ 1.5 <sup>b</sup>	13.0 $\pm$ 1.2

(a–d) Values in the same row without a common superscript are different ( $P < 0.05$ ).

### 3.3. Calving facilities

Most operations (74.1%) did not use any special facilities for calving. This accounted for 60.4% of all calvings. Thus, only 39.6% of calvings occurred in operations that used special calving facilities. Of those operations that did use special calving facilities, a pasture that allows increased observation and/or shelter was the most common type of calving facility used (21.1%). Use of a special area for calving was related to parity, geographic region, and herd size (Tables 10 and 11). Overall, 52.6% of operations with heifers calving did not use specialized facilities for calving. Another 25.1% of operations made use of special calving pastures that allowed increased observation or shelter. In contrast, 74.1% of operations did not use specialized areas for calving mature cows. Special calving pastures were used in 19.2% of operations calving cows. Operations in the west were more likely to use a specialized calving facility than operations in any of the

Table 10

Mean percentage of heifers or cows calving in various types of facilities by region

Calving location (means $\pm$ S.E.M.)	Region					
	West	North central	South central	Central	Southeast	All
<b>Heifers</b>						
Individual calving pens	10.5 $\pm$ 2.1 <sup>a</sup>	13.5 $\pm$ 2.3 <sup>a</sup>	1.9 $\pm$ 1.1 <sup>b</sup>	3.2 $\pm$ 1.5 <sup>b</sup>	1.2 $\pm$ 0.7 <sup>b</sup>	7.3 $\pm$ 1.0
Covered sheds or barns	12.5 $\pm$ 2.5 <sup>a</sup>	16.7 $\pm$ 3.7 <sup>a</sup>	2.4 $\pm$ 1.1 <sup>b</sup>	8.2 $\pm$ 2.3 <sup>a</sup>	0.4 $\pm$ 0.2 <sup>b</sup>	9.3 $\pm$ 1.2
Calving lots	27.6 $\pm$ 3.9 <sup>a,b</sup>	38.5 $\pm$ 5.9 <sup>a</sup>	4.0 $\pm$ 1.4 <sup>c</sup>	18.0 $\pm$ 4.9 <sup>b</sup>	2.6 $\pm$ 1.0 <sup>c</sup>	21.0 $\pm$ 2.0
Special calving pastures that allow increased observation and/or shelter	29.6 $\pm$ 4.3 <sup>a</sup>	27.6 $\pm$ 5.6 <sup>a,b</sup>	16.7 $\pm$ 3.2 <sup>b</sup>	31.9 $\pm$ 5.5 <sup>a</sup>	23.3 $\pm$ 4.5 <sup>a,b</sup>	26.0 $\pm$ 2.2
Other pastures, open range or other locations	19.8 $\pm$ 5.5 <sup>a</sup>	3.6 $\pm$ 0.9 <sup>b</sup>	75.0 $\pm$ 3.8 <sup>c</sup>	38.8 $\pm$ 5.5 <sup>d</sup>	72.6 $\pm$ 4.6 <sup>c</sup>	36.4 $\pm$ 2.5
<b>Cows</b>						
Individual calving pens	3.0 $\pm$ 0.8 <sup>a</sup>	5.2 $\pm$ 1.1 <sup>a</sup>	0.3 $\pm$ 0.2 <sup>b</sup>	1.1 $\pm$ 0.3 <sup>c</sup>	0.3 $\pm$ 0.2 <sup>b,c</sup>	2.0 $\pm$ 0.3
Covered sheds or barns	5.1 $\pm$ 1.0 <sup>a</sup>	7.2 $\pm$ 1.2 <sup>a</sup>	0.3 $\pm$ 0.2 <sup>b</sup>	5.9 $\pm$ 1.1 <sup>a</sup>	1.2 $\pm$ 0.4 <sup>b</sup>	3.7 $\pm$ 0.4
Calving lots	8.7 $\pm$ 1.7 <sup>a</sup>	19.6 $\pm$ 2.7 <sup>b</sup>	0.3 $\pm$ 0.2 <sup>c</sup>	6.9 $\pm$ 1.5 <sup>a</sup>	1.6 $\pm$ 0.6 <sup>d</sup>	7.3 $\pm$ 0.7
Special calving pastures that allow increased observation and/or shelter	33.0 $\pm$ 3.8 <sup>a</sup>	46.1 $\pm$ 3.8 <sup>b</sup>	4.4 $\pm$ 1.3 <sup>c</sup>	29.2 $\pm$ 3.2 <sup>a</sup>	13.2 $\pm$ 1.7 <sup>d</sup>	24.2 $\pm$ 1.5
Other pastures, open range or other locations	50.3 $\pm$ 3.9 <sup>a</sup>	22.2 $\pm$ 2.6 <sup>b</sup>	94.7 $\pm$ 1.3 <sup>c</sup>	56.9 $\pm$ 3.2 <sup>a</sup>	83.8 $\pm$ 1.8 <sup>d</sup>	62.9 $\pm$ 1.5

(a–d) Values in the same row without a common superscript are different ( $P < 0.05$ ).

Table 11

Mean percentage of heifers or cows calving in various types of facilities by herd size

Calving location (means $\pm$ S.E.M.)	Herd size (number of beef cows)				
	1–49	50–99	100–299	>300	All
<b>Heifers</b>					
Individual calving pens	4.6 $\pm$ 1.5 <sup>a</sup>	6.3 $\pm$ 1.6 <sup>a</sup>	8.8 $\pm$ 1.6 <sup>a</sup>	8.3 $\pm$ 2.6 <sup>a</sup>	7.3 $\pm$ 1.0
Covered sheds or barns	5.1 $\pm$ 1.2 <sup>a</sup>	9.0 $\pm$ 2.4 <sup>a,b</sup>	12.3 $\pm$ 2.1 <sup>b</sup>	9.0 $\pm$ 3.0 <sup>a,b</sup>	9.3 $\pm$ 1.2
Calving lots	9.3 $\pm$ 2.4 <sup>a</sup>	16.6 $\pm$ 2.7 <sup>b</sup>	23.5 $\pm$ 3.3 <sup>b,c</sup>	29.9 $\pm$ 5.8 <sup>c</sup>	21.0 $\pm$ 2.0
Special calving pastures that allow increased observation and/or shelter	20.6 $\pm$ 3.4 <sup>a</sup>	27.6 $\pm$ 3.7 <sup>a</sup>	24.4 $\pm$ 3.2 <sup>a</sup>	31.4 $\pm$ 5.9 <sup>a</sup>	26.0 $\pm$ 2.2
Other pastures, open range or other locations	60.5 $\pm$ 4.2 <sup>a</sup>	40.6 $\pm$ 3.9 <sup>b</sup>	31.0 $\pm$ 5.5 <sup>b,c</sup>	21.4 $\pm$ 4.0 <sup>c</sup>	36.4 $\pm$ 2.5
<b>Cows</b>					
Individual calving pens	1.5 $\pm$ 0.4 <sup>a</sup>	1.9 $\pm$ 0.6 <sup>a</sup>	2.3 $\pm$ 0.6 <sup>a</sup>	2.2 $\pm$ 0.8 <sup>a</sup>	2.0 $\pm$ 0.3
Covered sheds or barns	3.8 $\pm$ 0.6 <sup>a</sup>	4.1 $\pm$ 0.8 <sup>a</sup>	4.0 $\pm$ 0.8 <sup>a</sup>	2.6 $\pm$ 0.9 <sup>a</sup>	3.7 $\pm$ 0.4
Calving lots	4.8 $\pm$ 0.7 <sup>a</sup>	7.1 $\pm$ 1.2 <sup>a,b</sup>	8.8 $\pm$ 1.3 <sup>b</sup>	8.9 $\pm$ 2.8 <sup>a,b</sup>	7.3 $\pm$ 0.7
Special calving pastures that allow increased observation and/or shelter	18.2 $\pm$ 2.1 <sup>a</sup>	21.5 $\pm$ 2.0 <sup>a,b</sup>	28.0 $\pm$ 2.6 <sup>b</sup>	30.5 $\pm$ 5.3 <sup>b</sup>	24.2 $\pm$ 1.5
Other pastures, open range or other locations	71.7 $\pm$ 2.1 <sup>a</sup>	65.4 $\pm$ 2.4 <sup>a,b</sup>	57.1 $\pm$ 3.2 <sup>c</sup>	55.8 $\pm$ 5.0 <sup>b,c</sup>	62.9 $\pm$ 1.5

(a–d) Values in the same row without a common superscript are different ( $P < 0.05$ ).

other regions. A higher proportion of larger operations used specialized facilities for calving than smaller herds.

#### 4. Discussion

The results of this survey provide a view of calving management systems across the United States. All the practices evaluated ultimately shared a potential direct or indirect impact on calf survivability and reproductive efficiency. Despite the widespread dissemination of information on selection methods to prevent dystocia (EPDs, sire selection, pelvic measurement) [9,10], approximately 16.7% of heifers and 2.7% of cows still required some assistance in calving. Perhaps some of this is related to the low frequency of use of many of these reproductive management techniques [11]. The difference in rate of dystocia associated with heifers compared with cows is consistent with previous reports [1,6,12–17]. Bellows et al. [5] concluded that over 50% of losses of calves could be prevented by timely, correct obstetrical assistance. Thus, the optimization of all management factors contributing to this goal is advocated. This includes selection of a defined calving season, appropriate frequency of observation, appropriate timing of assistance, and use of appropriate calving facilities.

The lack of a defined breeding season for most operations is not surprising when one considers the diversity of the beef industry across herd sizes and region. In some cases, producers may feel that the lack of a defined calving season helps with ongoing cash flow

for the operation while others may feel that cows may actually have more lifetime calves without an imposed calving season. These perceptions may be more evident in smaller operations with the capability of year round grazing management systems. However, as operation size increases, presumably the cow–calf enterprise becomes more of a full-time business and thus, more operators would be expected to consolidate activities into defined periods such as calving seasons. Consolidation could focus labor requirements and lessen competition with other seasonal activities such as harvesting forages or grains. Additional advantages may be in the nutritional management of cows or heifers in similar stages of their production cycle and the ability to market a more uniform group of calves, which is crucial to getting the optimum price. These reasons, no doubt, are important considerations on individual operations within all regions.

Most surprising was the widespread difference that existed in frequency of observation and delayed timing of assistance in heifers and cows compared to widely published recommendations based on the normal events of calving and their relationship to overall reproductive efficiency [4–6]. Although over 90% of operations observed heifers or cows on a regular basis during the calving season, the frequency of observation was only every 6.7 h for heifers and 9.6 h for cows. These results are consistent with 93% of Ontario beef herds observing heifers at least twice per day [18]. They are much higher than that reported for herds in one region of Australia where only 44% of producers were observing heifers one or more times daily during the calving season [17]. Since calving problems are more common in heifers than cows it is understandable that the frequency of observation would generally be higher for heifers than for cows.

In addition, the average allowed labor time prior to assisting was 2.8 h for heifers and 3.5 h for cows. This, combined with the effects of infrequent observations, signifies that some heifers and cows are probably experiencing prolonged labor. Prolonged labor leads to a less vigorous calf which is more likely to experience failure of passive transfer of antibodies from the dam via colostrum, and more prone to hypothermia [4,5,19]. In addition, the dam, particularly the fatigued heifer, is less inclined to mother the calf properly. Most mature cows calve unassisted and in general do so quite rapidly. Prolonged labor in a cow is usually more indicative of a severe dystocia problem like malpositioning of the calf that will not respond to ongoing attempts to calve. In contrast, relative disproportion in size of the calf to the pelvic opening is most often the cause of dystocia in heifers. Delayed intervention in these cases is likely to result in a proportionately higher stillbirth rate, calf losses due to dystocia, failure of passive transfer, hypothermia, and prolonged interval to breeding [1,5,6,19]. Only 60.7% of operations intervened after 2 h or less of labor in heifers and 45.5% of operations intervened after 2 h or less of labor in cows. Opportunity for improvement is apparent.

The average frequency of observation and allowed labor time was related to herd size and region. Less frequent observation in smaller herds and those located in the southeast was probably indicative that operators had off-farm employment that did not allow observation more frequently than twice daily. In contrast, cows and heifers on operations in the west and north central regions were observed more frequently and assistance was provided to both in a significantly more timely fashion. This is most likely a function of either herd size or proportion of operations deriving full income from the cow–calf operation.

The relationship between attendance of assisted births by a veterinarian and geographic location and herd size was anticipated. In larger herds, some degree of specialization of labor is often present and experience level is often greater. Furthermore, distances from the veterinary clinic to the ranch in the west often necessitate some degree of self sufficiency. The higher proportion of cow assisted births attended by a veterinarian compared to heifers is likely due to the necessity to resolve a more difficult situation such as a malposition, malpresentation, or fetal deformity.

The use of specialized facilities may provide for increased observation frequency and more timely assistance and provide protection that would decrease calf death losses. Calves that were the product of a dystocia have a compromised ability to maintain their body temperature the first few hours after birth and are therefore more subject to the adverse impacts of the elements [19]. Still, a large proportion of the calvings (60.4% of cows and heifers that calved) did not occur in specialized calving facilities. The marked differences observed by region and herd size is probably related to costs for specialized areas for calving, weather, and availability of natural protection in existing pastures. For example, over 70% of heifers and 80% of cows in southeast region calved outside of specialized areas for calving compared to 3.6% of heifers and 22.2% of cows in the north central region. The small size of herds in the southeast, warmer climate, and abundance of natural protection compared to the larger herd size, colder climate, and more open terrain of the north central region are obvious contributors to the observed differences. Furthermore, the lack of a set calving season on many operations limits the opportunity to move animals about to calve into some specialized calving facility.

The current study provides a baseline description of selected calving management practices on a subpopulation of the nation's beef herds calving in 1996 and being from one of the 23 targeted study states. There are large differences in the management of cattle around calving by geographic region and herd size. This is especially evident when herds in the west and north central regions compared with those in the southeast. Herds in the west tend to manage the calving process more intensely by observing calving heifers and cows more frequently, assisting more calving heifers, and intervening earlier when heifers are having difficulty calving. Similarly, more intense calving management exists on operations with larger herds compared to those with smaller herds. With the information from this study, education and research programs can be targeted to areas that will help produce calves more efficiently. These results can also serve as a benchmark for making comparisons among herds and to the national average.

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